2009 ILRS Mission User Survey

Question	Daniel Navarro-Reyes/ESA	Luca Cerri, Jean-Paul Berthais/CNES
1. Mission Name	GIOVE-A, GIOVE-B, Galileo.	Jason-1 (CNES/NASA), Jason-2 (CNES/NASA/NOAA/Eumetsat, Envisat (ESA)
2. What is the role of the ILRS in your mission?	Provide SLR observations on a campaign basis.	ILRS provides - ranging measurements (in normal point format) used to tie the orbits (and thus the altimetry reference system) to the SLR accurate realization of the ITRS as well as to marginally improve orbit precision through additional precise tracking. SLR ranging measurements are also used to evaluate the accuracy of orbits obtained with other techniques (DORIS and/or GPS). - the information necessary to correctly process these measurements (recommended station coordinates and bias models, site logs, LRA information)
3. Are you receiving sufficient data volume?	Given the size of the LRR and the altitude of the satellites, the amount of data is fair.	Yes
4. Are you receiving sufficient spatial and temporal data coverage?	Spatial coverage is determined by the few stations able to range our satellites, so we have coverage mostly on the northern hemisphere, with very good coverage over Europe. Yarragadee has been providing most of the southern hemisphere data. Even though we did not expect to have data regularly, the SLR stations have been ranging our satellite almost daily. However, when we ask for a campaign, we do not see much increase in the amount of data (as an example, GIOVE-B is currently undergoing a SLR campaign but we get more GIOVE-A data than GIOVE-B's).	Yes, although the more the better. A better geographical distribution of the network (especially in the Southern hemisphere) would improve the tie to the reference system (and in particular the centering of the orbits).
5. Are the data of sufficient accuracy for your applications?	The RMS residuals we are measuring is about 20 cm. This is quite large, but we believe this is mostly due to our satellite's dynamics, which are not as simple as LAGEOS. In any case, the data has been of considerable help at the beginning of the mission when we did not have enough L-band sensor stations to perform accurate orbit determination. It provided enough robustness for our OD algorithm to converge. As we installed more sensor station, SLR data has helped to increase accuracy in the order of 30% (in some tests we have done). This has been very useful to characterise the clocks on-board (Rb and H-maser). However, we have had difficulties to use the data to characterise s/c models, such as SRP, the eclipse behaviour or the albedo effect. This is mostly due to not having enough L-band sensor stations (l-band based OD in the order of 30 cm error) and not enough SLR data (SLR based OD in the order of 1 m error).	Yes, for the core network of stations. Our Jason experience points to Yarragadee as the reference "good" station. On other stations unmodeled biases near or below the 1 cm level are clearly visible in the residuals; it would help if these biases were monitored on satellites at different altitudes, and possibly corrected. Given the accuracy achieved by current altimetry systems, and their goal to measure local variations in sea level height at mm/yr level, any improvements to the stability of the tie to the reference system are welcome.
6. What other products or data would you like to see from the ILRS?	Timely warnings about satellite not found by the stations, and biases whenfound (so we can check our CPF-generation process). Data processing of GIOVE satellites by other analysis centres, with summaries of residuals, etc, much like it is done for LAGEOS.	Official version "ILRS-endorsed" models for: - Station coordinates and biases (John Ries' LPOD05 is the current standard for Jason POD, its long term maintenance by the ILRS would be beneficial) - LRA range corrections beyond constant offsets
7. How do you access the data (CDDIS, EDC, etc.)? Any problems to report?	CDDIS. I believe we use EDC as backup. No problems to report.	CDDIS. No problem to report.
8. Are there future missions that will require laser tracking support? If so, please list with a time frame for launch.	GALILEO IOV (in orbit validation): 4 satellites GALILEO FOC (full operative constellation): 26 satellites Given the large amount of satellites, we would then request, strictly, ranging only on campaigns for specific satellites, as to not diverge SLR resources to satellites that are not being "assessed".	Foreseen POD activities at CNES: Cryosat-2, Dec. 2009 (ESA) HY-2A, mid 2010 (CNSA-NSOAS / CNES) followed by HY2B, HY2C, HY2D Altika/Saral, end 2010 (CNES/ISRO) Jason-3, 2013 (CNES/EUMETSAT/NASA/NOAA) Note that the Microscope mission is in a redesign phase; SLR tracking is not part of the current baseline
9. What other comments or suggestions do you have regarding the ILRS data and products in support of your mission requirements?	Support of ILRS has been very helpful, not only for the data provided, but also for the latest issues identified with the IOV LRR. The mission requirement for LRR issued by ILRS is also of help to us. However, we need to translate those requirements into high level LRR design (material, mass, size) needed for our future satellites. Some support in the sense of computing potential coverage, amount of data, and OD accuracy, analysis capabilities (s/c model characterisation, contribution to geodetic references), would be welcome. We recognize that this is an effort on both sides, ILRS and Galileo Project. From the Galileo project, we thank the effort and time dedicated by ILRS and associated stations to GIOVE and Galileo.	ILRS provides very accurate measurements that are essential for altimetry missions. If possible, biases should be monitored and documented for all stations. Real-time POD products are increasingly gaining importance among users. These products would benefit from a lower latency (few hours) of SLR normal points.

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Question	Frank Lemoine	Rolf Koenig/GFZ
1. Mission Name	Jason-1, Jason-2	CHAMP, GRACE, TerraSAR-X
2. What is the role of the ILRS in your mission?	Both altimeter missions rely on SLR tracking and the SLRF2005/LPOD2005 station complements for the precise orbits.	SLR serves as tracking system complementary to on-board GPS. Main science usage is validation/verification of the microwave based Precise Orbit Determination (POD).
3. Are you receiving sufficient data volume?	Yes	Yes, to fulfill the above role. No, if compared to space-borne GPS data yield.
4. Are you receiving sufficient spatial and temporal data coverage?	Yes, but only when in combination with DORIS or GPS to meet the OSTM 1.5 cm radial accuracy requirement. It would help to have more coverage in the Southern Hemisphere in general. For Jason-1 it would be very useful to have more SLR tracking. Since the demise of the GPS receiver and possible degradation of the DORIS oscillator the burden of maintaining Jason-1 orbit accuracy rests on quality SLR coverage.	Yes, to fulfill the above role. No, if compared to space-borne GPS data yield.
5. Are the data of sufficient accuracy for your applications?	Yes, for some stations. At the current level of 1-cm SLR processing even relatively small errors in the station position or the presence of relatively small station biases can degrade the solution. This was demonstrated showing serious degradation in the Jason-1 orbits when using the early SLRF2005/LPOD2005 positions for Herstmonceux and Zimmerwald. The position for Zimmerwald was corrected in an early version of LPOD2005, the position for Herstmonceux was corrected in the most recent version of LPOD2005.	Yes
6. What other products or data would you like to see from the ILRS?	SLRF2005/LPOD2005 are an essential contribution to the SLR community. With the next ITRF release, it may be necessary to generate a new ILRS-supported complete SLR complement.	ILRS should strive for near-real time data delivery, dense and equally distributed data yield in space and time, homogeneous accuracy through the network.
7. How do you access the data (CDDIS, EDC, etc.)? Any problems to report?	CDDIS. No problems	Both, CDDIS and EDC. Both, good service.
8. Are there future missions that will require laser tracking support? If so, please list with a time frame for launch.	Possibly GFO-2 (2013); Jason-3 (2013?); SWOT (2016?)	TanDEM-X, October 2009 (tracking already agreed). The augmented role of ILRS will be millimeter level calibration of the precise baseline (the range) between TerraSAR-X and TanDEM-X.
9. What other comments or suggestions do you have regarding the ILRS data and products in support of your mission requirements?	We are very grateful for the existing support and the above comments are intended to help further improve a very good product.	ILRS is really doing a great job considering its voluntary wide-spread composition of members and the all-time adverse circumstances for financing. Thank you so much for the support of these missions to the benefit of science.

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Question	Michiel Ottens/ESA	Juergen Mueller/IFE (from AAC survey)
1. Mission Name	Envisat	Lunar
2. What is the role of the ILRS in your mission?	The Laser Ranging tracking data is being used in the precise orbit determination of Envisat. The main usage of the precise orbit is the altimeter instrument onboard of Envisat.	We analyse all LLR data and generate standard and special solutions, especially related to Earth rotation and Gravitational Physics. But we also use all kinds of reference frame data and EOP series where major contributions are provided by SLR.
3. Are you receiving sufficient data volume?	Yes, but more tracking data is always welcome.	More Lunar Ranging data were very welcome, especially from more sites regulary tracking the Moon.
4. Are you receiving sufficient spatial and temporal data coverage?	Temporal yes, except during holidays like the Christmas new year period when there is always a big drop in tracking data. The reason for this is understood but a more temporal uniform tracking would be a welcome feature. A more spatial uniform tracking would clearly benefit the stability of the Envisat orbit so more none European tracking in the form of additional station would be highly appreciated.	No, both spatial and temporal coverage is poor at this time.
5. Are the data of sufficient accuracy for your applications?	Yes, but lower noise levels will always be welcome and directly benefitting the quality of the orbit and hence the performance of the altimeter.	The data quality is quite good.
6. What other products or data would you like to see from the ILRS?	None	If better predictions of the lunar reflectors were available, may be, more (SLR) sites would track the Moon.
7. How do you access the data (CDDIS, EDC, etc.)? Any problems to report?	Through CDDIS, no problems to report	We use bot and have no problems.
8. Are there future missions that will require laser tracking support? If so, please list with a time frame for launch.	- PROBA-2 (Second quarter 2009) - CRYOSAT-2 (December-2009) - SWARM (2011) - SENTINEL-3 (2012/2014) - GALILEO (2014)	
9. What other comments or suggestions do you have regarding the ILRS data and products in support of your mission requirements?	None	It would be helpful if the ILRS could push lunar tracking.

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Question	Toyoshima Morio/NICT	Takahiro Inoue/JAXA
1. Mission Name	ETS-8	SOHLA-1
2. What is the role of the ILRS in your mission?	Kirari Optical Communications Demonstration Experiments with the NICT optical ground station (KODEN). Orbital calculation for the initial acquisition of the satellite.	Calibration and validation of the GPSR data.
3. Are you receiving sufficient data volume?	Yes. But how was the number of data observed in the world?	Yes. JAXA can evaluate the GPSR data by using sufficient SLR data.
4. Are you receiving sufficient spatial and temporal data coverage?	Yes. But how was the number of data observed in the world?	Yes. JAXA can evaluate the GPSR data by using sufficient SLR data. Especially in European area, SOHLA-1 was obsereved by three or four stations at the same time.
5. Are the data of sufficient accuracy for your applications?	The data had sufficient accuracy to establish the optical communications links.	Yes. SLR data are much more accurate than GPSR data.
6. What other products or data would you like to see from the ILRS?	There is no idea for the time being.	If we have a chance to request a next campaign, we'd like to obtain their full-rate data because of spin rate analysis for SOHLA-1. (But JAXA will not request the next SOHLA-1campaign.)
7. How do you access the data (CDDIS, EDC, etc.)? Any problems to report?	NICT used CDDIS as the main access via FTP, and NICT did not use EDC. We did not report because we did not perform the ranging measurement but the laser communications,	Everytime we access the CDDIS and EDC when we want to get CPFs, and put NPs. Everytime it went very well.
8. Are there future missions that will require laser tracking support? If so, please list with a time frame for launch.	NICT will participate in QZS adn ASTRO-G with JAXA.	JAXA plans to request the tracking campaign listed below. - QZS:2010 - ASTRO-G:2012
9. What other comments or suggestions do you have regarding the ILRS data and products in support of your mission requirements?	I think ILRS is the best means to determine the precise orbit. In the future, we want to use ILRS to track future new laser communications satellites if possible (but there is no plan now). Thank you very much again for your support for the past campaigns.	We receive great amount of benefit from ILRS data and thank you for your kind support. We'd like to contribute more tracking data to the ILRS and satellite missions.